# Having fun with only 200 mW and an End-Fed Antenna

## (Building and Testing an Effective End-Fed Antenna design for 160- 10 Meters)

Ron, K8RJH

If you are looking for that first HF antenna, or just wanting to experiment with another antenna for the Amateur shortwave bands, consider the option to use an end-fed long wire. When configured and built properly, it can operate with good results for both the new amateur and seasoned DX contester on the popular Ham bands with a relative low cost for the home or portable station.

My initial requirements were to attempt an end-fed design to take advantage of using a tall tree as an end support and allow operation on several HF ham bands. In addition, the appeal of selecting a broadband design would allow an internal tuner of a modern HF solid-state transceiver to compensate expected residual antenna SWR (typically under 3:1) without external tuners. Another objective was that the parts to construct the antenna may be used for temporary or portable applications and be easily duplicated for new installations. My original intended use of this antenna was to demonstrate radio theory for new amateurs and STEM students. I ended up with an effective design that is now part of my home station for the amateur low bands.

The simple description of this end-fed antenna design consists of a suspended wire that is a non-resonant (non-harmonic) 135 foot length, connected to a matching transformer (balun) and fed with common 50 Ohm coax to the station transceiver. Shorter wire lengths may be used based on lot size and landscape availability. A good reference on End fed non-resonant lengths and the amateur bands that they cover may be found in a University of Delaware engineering paper https://udel.edu/~mm/ham/randomWire/

The fun part was constructing the antenna and “tuning” the wire length, ground radials, balun wiring, and testing of the installation to see how close I came to the “text book” theory. I was initially very encouraged to see how the end-fed actually performed when connected to an antenna analyzer. Seeing that the VSWR matches were well below 3:1 for the popular ham bands, I connected a 200 mW (that’s only 0.2 watt) WSPR beacon transmitter and monitored the surprising results for a week (Check out the report graphic from wsprnet.org ). No doubt, this antenna is a performer!

The next steps are to make incremental changes to the ground plane radials to improve the SWR metrics on 160 and 80 meters this summer and weatherproof the feed point network for the upcoming fall and winter weather. In the meantime, I’ll enjoy working the HF Bands!

Reference: These Non-resonant, Non-Harmonic antenna designs have been presented in several articles that can be researched on the internet, with one of the earliest writings found in QST, March 1936, p. 32, "An Unorthodox Antenna"

Additional information on WSPR Beacons can be found at https://www.instructables.com/WSPR-Weak-Signal-Propagation-Reporter-Stand-Alone-/

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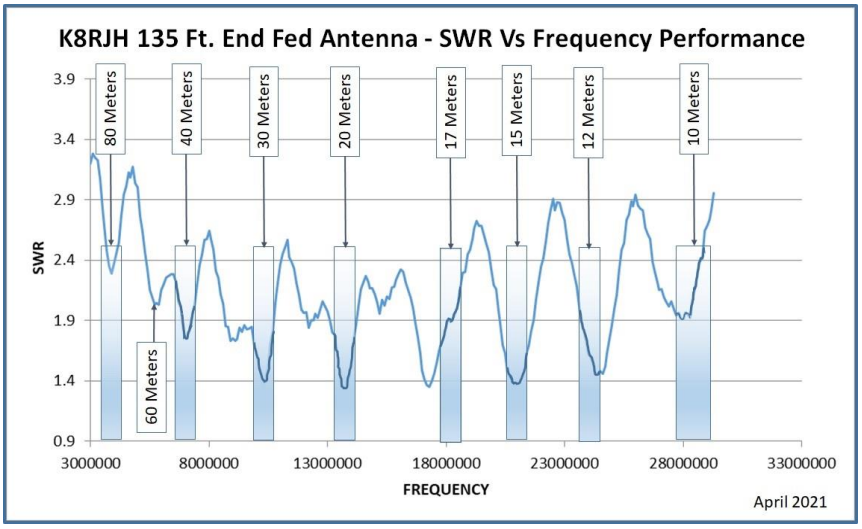
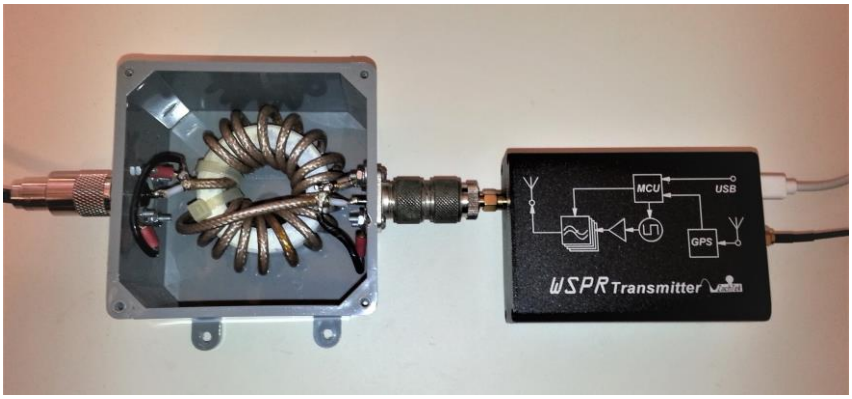
----------Photos with Comments follow below ----------

**End Fed Matching Balun Transformer at the K8RJH Long Wire Antenna Site.**

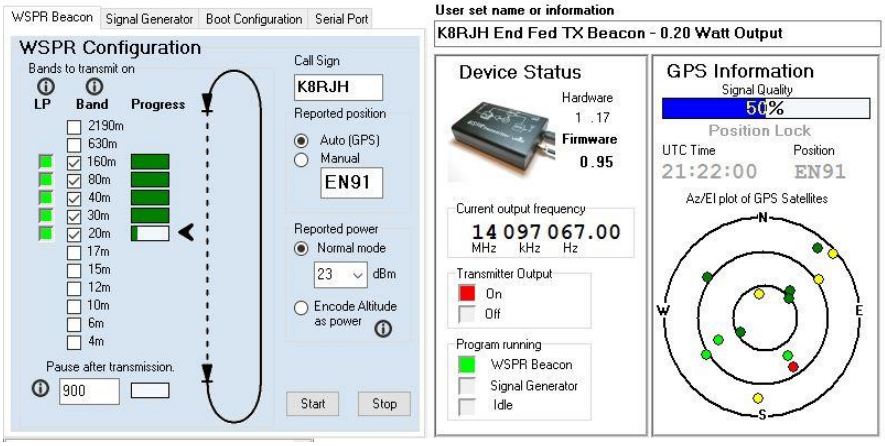
Description: The installation is 8 Ft above ground level and is open air to allow for convenient access and testing. The Balun Material is two cores of Type 52 with five quadrifilar windings through the core. The white wire is the 5 turn primary with the red wires being the secondary that matches the antenna with a 1:16 turns ratio. This is necessary as the Endfed feed point is elevated above ground more than several feet. The far end of the antenna is approximately 95 feet in height giving an antenna slope of around 40 degrees. There are two surface ground radials at 35 ft length connected to the feed point coax connector and placed pointed away from the direction of the wire antenna. A coax current choke is placed at the radio end to isolate the ground loop into the station equipment.



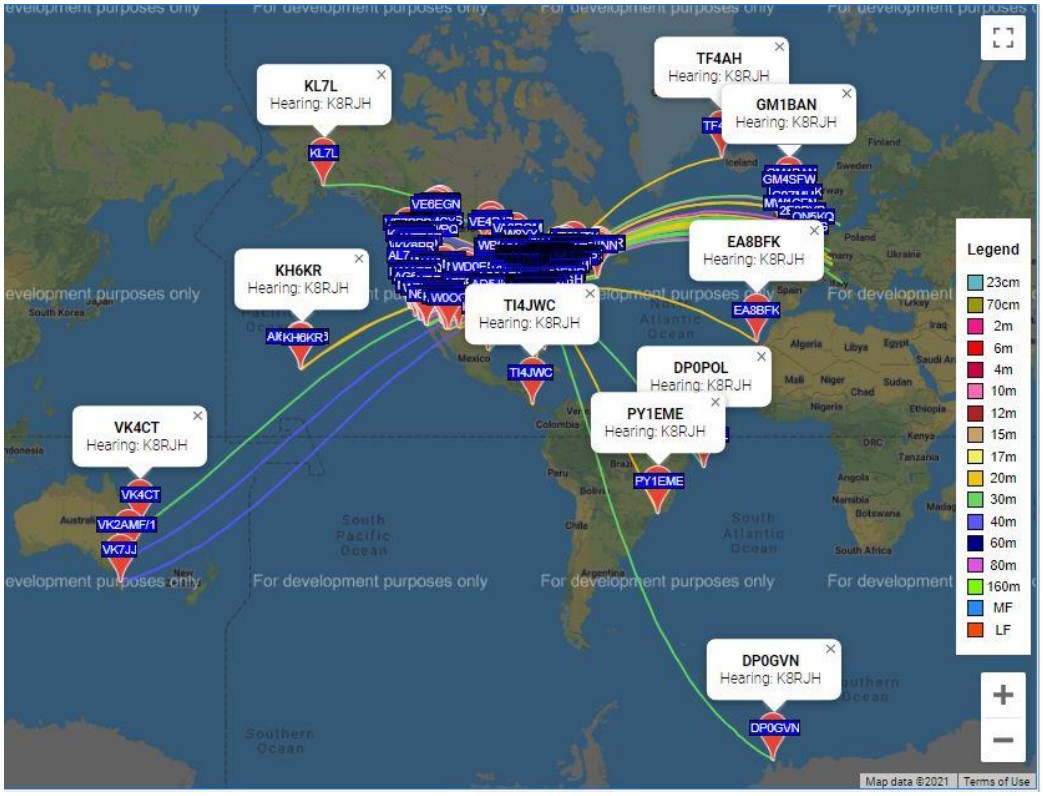

The actual VSWR curves as measured by an antenna analyzer show the matching circuit of the Balun wirings and grounding network are close to “textbook” for this installation.




This is the K8RJH Beacon Station. The WSPR transmitter unit is connected to the coax current choke (cover removed) and placed on the air. This WSPR transmitter unit only transmits at 200 mW (0.2 Watt) RF power.




The WSPR Beacons Settings page is set to transmit a beacon signal stepping from 160 meters to 20 meters with a pause of 15 minutes before repeating the cycle. Since this is a weak signal protocal, each beacon transmission per band takes under a minute to transmit. This unit uses a GPS receiver to provide timing and location reference for the transmitted WSPR signal.




**End-Fed Antenna Results:** The 200 mw (0.2 Watt) Beacon Reception from K8RJH End-Fed Long wire for 160 through 20 meters in a 24 Hour period as recorded for April 12, 2021 on www.wsprnet.org . The sloping wire installation of the Endfed seems to have both horizontal and vertical radiation features, which makes this a good general purpose antenna solution for Amateur RF.